

## SECTION 19A – INTRAVASCULAR CATHETERS

**I. GENERAL.** The *Guidelines for the Prevention of Intravascular Catheter-Related Infections* have been developed for practitioners who insert catheters and for persons who are responsible for surveillance and control of infections in hospital, outpatient, and home health-care settings.

**II. REFERENCE:** This guideline was prepared by a working group composed of professionals representing the disciplines of critical care medicine, infectious diseases, health-care infection control surgery, anesthesiology, interventional radiology, pulmonary medicine, pediatrics, and nursing. The working group was led by the Society of Critical Care Medicine (SCCM), in collaboration with Infectious Disease Society of America (IDSA), Society for Healthcare Epidemiology of America (SHEA), Surgical Infection Society (SIS), American College of Chest Physicians (ACCP), American Thoracic Society (ATS), American Society of Critical Care Anesthesiologists (ASCCA), Association for Professionals in Infection Control and Epidemiology (APIC), Infusion Nurses Society (INS), Oncology Nursing Society (ONS), Society of Cardiovascular and Interventional Radiology (SCVIR), American Academy of Pediatrics (AAP), and the Healthcare Infection Control Practices Advisory Committee (HICPAC) of the Centers for Disease Control and Prevention (CDC). The recommendations presented in the guideline reflect the consensus of HICPAC and other professional organizations.

O'Grady, Naomi, et al. Guidelines for the Prevention of Intravascular Catheter-Related Infections, MMWR, August 9, 2002/51(RR10); 1-26.

<http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5110a1.htm>

### III. SPECIFIC

#### A. Selection and replacement of intravascular catheters

- Select the catheter, insertion technique, and insertion site with the lowest risk for complications (infectious and noninfectious) for the anticipated type and duration of IV therapy.
- Promptly remove any intravascular catheter that is no longer essential.
- Do not routinely replace central venous or arterial catheters solely for the purposes of reducing the incidence of infection.
- Replace peripheral venous catheters at least every 72–96 hours in adults to prevent phlebitis. Leave peripheral venous catheters in place in children until IV therapy is completed, unless complications (e.g., phlebitis and infiltration) occur
- When adherence to aseptic technique cannot be ensured (i.e., when catheters are inserted during a medical emergency), replace all catheters as soon as possible and after no longer than 48 hours.
- Replace any short-term CVC if purulence is observed at the insertion site, which indicates infection.
- Replace all CVCs if the patient is hemodynamically unstable and CRBSI is suspected.
- Do not use guidewire techniques to replace catheters in patients suspected of having catheter-related infection.

**B. Aseptic technique during catheter insertion and care**

- Maintain aseptic technique for the insertion and care of intravascular catheters
- Wear clean or sterile gloves when inserting an intravascular catheter as required by the Occupational Safety and Health Administration Bloodborne Pathogens Standard.
- Wearing clean gloves rather than sterile gloves is acceptable for the insertion of peripheral intravascular catheters if the access site is not touched after the application of skin antiseptics. Sterile gloves must be worn for the insertion of arterial and central catheters.
- Disinfect clean skin with an appropriate antiseptic before catheter insertion and during dressing changes. Although a 2% chlorhexidine-based preparation is preferred, tincture of iodine, an iodophor, or 70% alcohol can be used.
  - No recommendation can be made for the use of chlorhexidine in infants aged <2 months.
- Allow the antiseptic to remain on the insertion site and to air dry before catheter insertion. Allow povidone iodine to remain on the skin for at least 2 minutes, or longer if it is not yet dry before insertion.
- Do not apply organic solvents (e.g., acetone and ether) to the skin before insertion of catheters or during dressing changes.
- Wear clean or sterile gloves when changing the dressing on intravascular catheters.
- Do not routinely use arterial or venous cut down procedures as a method to insert catheters.

**C. Catheter Site Dressing Regimens – See Appendix B**

- Transparent, semipermeable polyurethane dressings reliably secure the device, permit continuous visual inspection of the catheter site, permit patients to bathe and shower without saturating the dressing, and require less frequent changes than do standard gauze and tape dressings; the use of these dressings saves personnel time.
- In the largest controlled trial of dressing regimens on peripheral catheters, suggest that the rate of colonization among catheters dressed with transparent dressings (5.7%) is comparable to that of those dressed with gauze (4.6%) and that no clinically substantial differences exist in either the incidences of catheter site colonization or phlebitis.
- Furthermore, these data suggest that transparent dressings can be safely left on peripheral venous catheters for the duration of catheter insertion without increasing the risk for thrombophlebitis.
- Use either sterile gauze or sterile, transparent, semipermeable dressing to cover the catheter site. If blood is oozing from the catheter insertion site, gauze dressing might be preferred.
- Tunneled CVC sites that are well healed might not require dressings\
- If the patient is diaphoretic, or if the site is bleeding or oozing, gauze dressing is preferable to a transparent, semi-permeable dressing.
- Replace catheter-site dressing if the dressing becomes damp, loosened, or visibly soiled.

- Change dressings at least weekly for adult and adolescent patients depending on the circumstances of the individual patient.
- Do not use topical antibiotic ointment or creams on insertion sites (except when using dialysis catheters) because of their potential to promote fungal infections and antimicrobial resistance.
- Do not submerge the catheter under water. Showering should be permitted if precautions can be taken to reduce the likelihood of introducing organisms into the catheter (e.g., if the catheter and connecting device are protected with an impermeable cover during the shower).

#### **D. Needleless Intravascular Catheter Systems**

- Attempts to reduce the incidence of sharp injuries resultant risk for transmission of bloodborne infections health-care workers have led to the design and introduction needleless infusion systems. When the devices are according to manufacturers' recommendations, they substantially affect the incidence of catheter-related bloodstream infection (CRBSI).
- Minimize contamination risk by wiping the access port with an appropriate antiseptic and accessing the port only with sterile devices.
- All ports must be adequately disinfected with an alcohol swab prior to injecting.
- Change the needleless components at least as frequently as the administration set, but no more frequently than every 72 hours or according to manufacturers' recommendations.
- Exercise caution with the handling of caps and locks to prevent contamination
  - Cap all stopcocks when not in use.
  - Ensure that all components of the system are compatible to minimize leaks and breaks in the system

#### **E. Multidose Parenteral Medication Vials**

- Parenteral medications commonly are dispensed multidose, parenteral medication vials that might be prolonged periods for one or more patients.
- Although the risk for extrinsic contamination of multidose vials minimal, the consequences of contamination result in life-threatening infection.
- Label and date when opened.
- Discard at 30 days or sooner if indicated by manufacturer.
- Use a sterile device to access a multidose vial and avoid touch contamination of the device before penetrating the access diaphragm
- Single- dose vials are frequently preservative-free and might pose a contamination if they are punctured several times.
- Discard multidose vial if sterility is compromised.

#### **F. Performance Indicators** for reducing CRBSI are:

- implementation of educational programs that include didactic and interactive components for those who insert and maintain catheters;
- use of maximal sterile barrier precautions during catheter placement;
- use of chlorhexidine for skin antisepsis; and

- rates of catheter discontinuation when the catheter is no longer essential for medical management.

#### **G. Health-care worker education and training**

- Educate health-care workers regarding the indications for intravascular catheter use, proper procedures for the insertion and maintenance of intravascular catheters, and appropriate infection control measures to prevent intravascular catheter – related Infections.
- Assess knowledge of and adherence to guidelines periodically for all persons who insert and manage intravascular catheters.
- Ensure appropriate nursing staff levels in ICUs to minimize the incidence of CRBSIs.

#### **H. Surveillance**

- Monitor the catheter sites visually or by palpation through the intact dressing on a regular basis, depending on the clinical situation of individual patients. If patients have tenderness at the insertion site, fever without obvious source, or other manifestations suggesting local or BSI, the dressing should be removed to allow thorough examination of the site.
- Encourage patients to report to their health-care provider any changes in their catheter site or any new discomfort.
- Record the operator, date, and time of catheter insertion and removal, and dressing changes on a standardized form.
- Do not routinely culture catheter tips.
- Conduct surveillance in ICUs and other patient populations to determine CRBSI rates, monitor trends in those rates, and assist in identifying lapses in infection control practices
- Investigate events leading to unexpected life-threatening or fatal outcomes. This includes any process variation for which a recurrence would likely present an adverse outcome

#### **I. Hand hygiene**

- Observe proper hand-hygiene procedures either by washing hands with conventional antiseptic-containing soap and water or with waterless alcohol-based gels or foams.
- Observe hand hygiene before and after palpating catheter insertion sites, as well as before and after inserting, replacing, accessing, repairing, or dressing an intravascular catheter. Palpation of the insertion site should not be performed after the application of antiseptic, unless aseptic technique is maintained.
- Use of gloves does not obviate the need for hand hygiene

#### **J. Replacement of administration sets and parenteral fluids -See Appendix B**

#### **K. Peripheral Venous Catheters**

Select catheters on the basis of the intended purpose and duration of use, known complications (e.g., phlebitis and infiltration), and experience of individual catheter operators

A. **In adults**, use an upper- instead of a lower-extremity site for catheter insertion. Replace a catheter inserted in a lower-extremity site to an upper-extremity site as soon as possible

B. **In pediatric patients**, the hand, the dorsum of the foot, or the scalp can be used as the catheter insertion site.

- Avoid the use of steel needles for the administration of fluids and medication that might cause tissue necrosis if extravasation occurs
- Use a midline catheter or PICC when the duration of IV therapy will likely exceed 6 days
- Evaluate the catheter insertion site daily, by palpation through the dressing to discern tenderness and by inspection if a transparent dressing is in use.
  - Gauze and opaque dressings should not be removed if the patient has no clinical signs infection.
  - If the patient has local tenderness or other signs of possible CRBSI, an opaque dressing should be removed and the site inspected visually.
- Remove peripheral venous catheters if the patient develops signs of phlebitis (e.g., warmth, tenderness, erythema, and palpable venous cord), infection, or a malfunctioning catheter.
- In adults, replace short, peripheral venous catheters at least 72–96 hours to reduce the risk for phlebitis. If sites for venous access are limited and no evidence of phlebitis or infection is present, peripheral venous catheters can be left in place for longer periods, although the patient and the insertion sites should be closely monitored
- Do not routinely replace midline catheters to reduce the risk for infection.
- In pediatric patients, leave peripheral venous catheters in place until IV therapy is completed, unless a complication (e.g., phlebitis and infiltration) occurs
- Do not routinely apply prophylactic topical antimicrobial or antiseptic ointment or cream to the insertion site of peripheral venous catheters

#### **L. Central Venous Catheters (CVC)**

Use totally implantable access devices for patients who require long-term, intermittent vascular access. For patients requiring frequent or continuous access, a peripherally inserted central catheter (PICC) or tunneled CVC is preferable.

- Use a CVC with the minimum number of ports or lumens essential for the management of the patient.
- Use an antimicrobial or antiseptic-impregnated CVC in adults whose catheter is expected to remain in place >5 days.
- Reduction of catheter-related bloodstream infection (CRBSI) is directly related to STRICT ENFORCEMENT of the following three components:
  1. Educating 100% of all persons who insert and maintain CVCs
    - Designate personnel who have been trained and exhibit competency in the insertion of catheters to supervise trainees who perform catheter insertion.
  2. AT ALL TIMES: STRICT ENFORCEMENT of the use of maximal sterile barrier precautions: A surgical cap, mask, sterile gown, sterile gloves, and a large sterile sheet (cover patient from head to toe)

3. Use a 2% chlorhexidine preparation for skin antisepsis during CVC insertion

**1. Selection of catheter insertion site**

- Weigh the risk and benefits of placing a device at a recommended site to reduce infectious complications against the risk for mechanical complications (e.g., pneumothorax, subclavian artery puncture, subclavian vein laceration, subclavian vein stenosis, hemothorax, thrombosis, air embolism, and catheter misplacement)
- Use a subclavian site (rather than a jugular or a femoral site) in adult patients to minimize infection risk for nontunneled CVC placement. **Avoid femoral placement!**
- Use a sterile sleeve to protect pulmonary artery catheters during insertion
- Do not remove CVCs or PICCs on the basis of fever alone. Use clinical judgment regarding the appropriateness of removing the catheter if infection is evidenced elsewhere or if a noninfectious cause of fever is suspected.
- Designate one port exclusively for hyperalimentation if a multilumen catheter is used to administer parenteral nutrition.
- Do not routinely use antibiotic lock solutions to prevent CRBSI.

**2. Guidewire exchange**

- Do not use guidewire exchanges routinely for nontunneled catheters to prevent infection
- Use a guidewire exchange to replace a malfunctioning nontunneled catheter if no evidence of infection is present
- Use a new set of sterile gloves before handling the new catheter when guidewire exchanges are performed

**M. Peripheral Arterial Catheters and Pressure Monitoring Devices**

- Use only disposable transducer assemblies.
- Keep all components of the pressure monitoring system (including calibration devices and flush solution) sterile.
- Minimize the number of manipulations of and entries into the pressure monitoring system. Use a closed-flush system (i.e., continuous flush), rather than an open system (i.e., one that requires a syringe and stopcock), to maintain the patency of the pressure monitoring catheters.
- When the pressure monitoring system is accessed through a diaphragm rather than a stopcock, wipe the diaphragm with an appropriate antiseptic before accessing the system.
- Do not administer dextrose-containing solutions or parenteral nutrition fluids through the pressure monitoring circuit.

**N. Umbilical Catheters**

- Remove and do not replace umbilical **artery** catheters if any signs of CRBSI, vascular insufficiency, or thrombosis are present
- Remove and do not replace umbilical **venous** catheters if any signs of CRBSI or thrombosis are present.

- No recommendation can be made for treating through an umbilical venous catheter suspected of being infected – it is an **unresolved issue**.
- Replace umbilical venous catheters only if the catheter malfunctions.
- Cleanse the umbilical insertion site with an antiseptic before catheter insertion. - -
  - Avoid tincture of iodine because of the potential effect on the neonatal thyroid. Other iodine-containing products (e.g., povidone-iodine) can be used
- Do not use topical antibiotic ointment or creams on umbilical catheter insertion sites because of the potential to promote fungal infections and antimicrobial resistance.
- Add low doses of heparin (0.25–1.0 F/ml) to the fluid infused through umbilical arterial catheters
- Remove umbilical catheters as soon as possible when no longer needed or when any sign of vascular insufficiency to the lower extremities is observed.
  - Optimally, **umbilical artery** catheters should not be left in place >5 days
  - Umbilical **venous** catheters should be removed as soon as possible when no longer needed but can be used up to 14 days if managed aseptically.

## DeWitt Health Care Network: Appendix A

### Types of Catheters Used for Venous and Arterial Access

Catheter Type	Entry Site	Length	Comments
<b>Peripheral Venous Catheters (Short)</b>	Usually inserted in veins of forearm or hand	<3 inches; rarely associated with bloodstream infection	Phlebitis with prolonged use; rarely associated with bloodstream infection
<b>Peripheral arterial catheters</b>	<3 inches; associated with bloodstream infection	3 inches; associated with bloodstream infection	Low infection risk; rarely associated with bloodstream infection
<b>Midline catheters</b>	Inserted via the antecubital fossa into the proximal basilic or cephalic veins; does not enter central veins, peripheral catheters	3 to 8 inches	Anaphylactoid reactions have been reported with catheters made of elastomeric hydrogel; lower rates of phlebitis than short peripheral catheters
<b>Non tunneled central venous Catheters (CVC)</b>	Percutaneously inserted into central veins (subclavian, internal jugular, or femoral)	>8 cm depending on patient size	Account for majority of CRBSI
<b>Pulmonary artery catheters (PAC)</b>	Inserted through a Teflon® introducer in a central vein (subclavian, internal jugular, or femoral)	>30 cm depending on patient size	Usually heparin bonded; similar rates of bloodstream infection as CVCs; subclavian site preferred to reduce infection risk



<b>Peripherally inserted central venous catheters (PICC)</b>	Inserted into basilic, cephalic, or brachial veins and enter the superior vena cava	>20 cm depending on patient size	Lower rate of infection than Non- tunneled CVCs
<b>Tunneled central venous catheters</b>	Implanted into subclavian, internal jugular, or femoral veins	>8 cm depending on patient size	Cuff inhibits migration of organisms into catheter tract; lower rate of infection than nontunneled CVC
<b>Totally implantable</b>	Tunneled beneath skin and have subcutaneous port accessed with a needle; implanted in subclavian or internal jugular vein	>8 cm depending on patient size	Lowest risk for CRBSI; improved patient self-image; no need for local catheter-site care; surgery required for catheter removal
<b>Umbilical Catheters</b>	Inserted into either umbilical vein or umbilical artery	Inserted into either umbilical vein or umbilical artery	Risk for CRBSI similar with catheters placed in umbilical vein versus artery

## DeWitt Health Care Network: Appendix B

### Recommended Frequency of Replacements for Catheters, Dressings, Administration Sets, & Fluids

Catheter	Replacement & Relocation of IV site	Replacement of catheter site dressing	Replacement of administration sets	Hang time for parenteral fluids
Peripheral Venous Catheters	<p><b>ADULTS:</b> Rotate site at 72-96 hours.</p> <p>Replace catheters inserted under emergency basis and insert a new catheter at a different site within 48 hours.</p> <p><b>PEDIATRIC:</b> Do not replace peripheral catheters unless clinically indicated.</p>	<p>Replace dressing when the catheter is removed or replaced, or when the dressing becomes damp, loosened, or soiled. Replace dressings more frequently in diaphoretic patients.</p> <p>In patients who have large bulky dressings that prevent palpation or direct visualization of the catheter insertion site, remove the dressing and visually inspect the catheter at least daily and apply a new dressing.</p>	<p>Replace intravenous tubing, including add-on or piggy-back devices, no more frequently than at 72-hour intervals unless clinically indicated. Maintain sterile connections.</p> <p>Consider short extension tubing connected to the catheter to be a portion of the device. Replace such extension tubing when the catheter is changed.</p> <p><b><u>Blood Administration</u></b></p> <p>Replace tubing used to administer blood, blood products, or lipid emulsions within 24 hours of initiating the infusion.</p>	<p>Parenteral nutrition fluids – change at 24-48 hours.</p> <p>Complete infusion of lipid emulsions <b>alone</b> within 12 hours of hanging the fluid.</p> <p><b><u>Blood Administration</u></b></p> <p>Complete infusions of blood products within 4 hours of hanging the product.</p>
Peripheral arterial catheters (PAC)	<p><b>ADULTS:</b> Do not routinely replace PAC to prevent catheter related-infection</p>	<p>Replace dressing when the catheter is replaced, or when the dressing becomes damp, loosened, or soiled, or when inspection of the site is necessary.</p>	<p>Replace the intravenous tubing and continuous flush device at the same time the transducer is replaced - Recommended at 72 hour intervals.</p>	<p>Replace the flush solution at the time the transducer is replaced (i.e., 72-hr intervals).</p>
PAC ( <b>PEDS</b> )	PEDIATRIC: No recommendation for the frequency of Peripheral arterial catheter replacement.			

<b>CVC:</b> Central venous Catheters  <b>PICC lines</b> Peripherally-inserted central catheters  <b>HAD:</b> Hemodialysis catheters	<b>ADULTS:</b> Do not routinely replace catheters.	Replace gauze dressings every 2 days and transparent dressings every 7 days on short-term catheters.  Replace the dressing when the catheter is replaced, or when the dressing becomes damp, loosened, or soiled, or when inspection of the site is necessary.  Replace dressings used on tunneled or implanted CVC sites no more than once per week, until the insertion site has healed  No recommendation can be made regarding the necessity for any dressing on well-healed exit sites of long-term cuffed and tunneled CVCs.	Replace intravenous tubing and add-on devices no more frequently than at 72-hour intervals  Replace tubing used to administer blood products or lipid emulsions within 24 hours of initiating the infusion.  Replace transducers at 72 hour intervals. Replace continuous flush device at the same time.	No recommendation for the hang time of intravenous fluids, including nonlipid-containing parenteral nutrition fluids. Complete infusions of lipid-containing fluids within 24 hours of hanging the fluid.
<b>CVC; PICC, HAD lines</b>  <b>PEDIATRICS</b>	No recommendation for the frequency of catheter replacement.	Replace the dressing when the catheter is replaced, or when the dressing becomes damp, loosened, or soiled, or when inspection of the site is necessary, except in those pediatric patients in which the risk for dislodging the catheter outweighs the benefit of changing the dressing.	As above	
Umbilical catheters	Do not routinely replace catheters.	Not applicable	Replace intravenous tubing and add on devices no more frequently than at 72-hour intervals.  Replace tubing used to administer blood products or lipid emulsions within 24 hours of initiating the infusion.	No recommendation for the hang time of intravenous fluids, including nonlipid-containing parenteral nutrition fluids. - Complete infusion of lipid containing fluids within 24 hours of hanging the fluid. Includes non-tunneled catheters, tunneled catheters, and totally implanted devices.

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